UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/586,624	06/02/2000	Naoya Hasegawa	9281/3660	6578

757 7590 05/06/2002

BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, IL 60610

EXAMINER
BERNATZ, KEVIN M

ART UNIT	PAPER NUMBER
1773	6

DATE MAILED: 05/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

mk-6

Office Action Summary	Application No.	Applicant(s)	
	09/586,624	HASEGAWA, NAOYA	
	Examiner	Art Unit	
	Kevin M Bernatz	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-14 is/are pending in the application.

4a) Of the above claim(s) 10-14 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-10 is/are rejected.

7)☒ Claim(s) 1 and 3-6 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Response to Amendment

1. Preliminary amendments to the specification and claims 1 - 10, filed on June 2, 2000, have been entered in the above-identified application.

Election/Restrictions

2. Applicant's election of Group 1, claims 1 – 9 in Paper No. 5 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Specification

3. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract of the disclosure is now limited to 150 words or 15 lines (37 CFR 1.72). See MPEP § 608.01(b).

The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

5. Claim 1 is objected to because of the following informalities: claim 1, line 9: remove "and" from after "soft magnetic layers". Appropriate correction is required.

6. Claims 1 and 3 – 6 are objected to because of improper Markush language. The proper language is either "...selected from a group consisting of A, B, C and D." or "...is A, B, C or D." See MPEP § 2173.05(h). The examiner notes that the current language is confusing because "Xe and Kr, as well as Mn" could be interpreted to mean that "Mn" is part of the listing of elements. Rewording the claim using the accepted Markush language above would be sufficient to remove any confusion. For the purpose of evaluating the prior art, the claim was interpreted to mean an Mn-X alloy where X is chosen from the list of elements Pt, Pd ... Xe and Kr.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1 – 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1 - 9, the phrase "spin-valve type" renders the claim indefinite. The addition of the word “type” to an otherwise definite expression extends the scope of the expression so as to render it indefinite. *Ex parte Copenhaver*, 109 USPQ 118 (Bd.App. 1955). See MPEP § 2173.05(e).

Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the relative location of the electrically conductive layers. For purpose of evaluating the prior art, these layers were interpreted as the leads of the MR sensor and were therefor assumed to be deposited on said bias layers (as per applicants' Figures).

Claim R jections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

10. Claims 1, 7 and 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin (U.S. Patent No. 6,074,767).

Regarding claim 1, the claimed invention reads on Lin as follows: Lin discloses a spin-valve magnetoresistive (MR) sensor comprising, on a substrate (Figure 3, element 17), an antiferromagnetic layer (element AFM_1), a pinned magnetic layer formed in contact with said antiferromagnetic layer (element 32) and having a magnetization direction made stationary under an exchange anisotropic magnetic field generated by interaction with said antiferromagnetic layer (col. 5, lines 54 – 58), a non-magnetic electrically conductive layer (element 35) formed between a free magnetic layer (element 36) and said pinned magnetic layer, soft magnetic layers (elements 41) arranged on said free magnetic layer, bias layers (elements AFM_2) formed on said soft magnetic layers to uniformly arrange a magnetization direction of said free magnetic layer in a direction crossing the magnetization direction of said pinned magnetic layer (col. 5, lines 63 – 66; col. 6, lines 50 – 54; col. 6, line 65 bridging col. 7, line 2), and electrically conductive layers (element 43) to apply a detection electric current to said free magnetic layer (intended use limitation, but see col. 7, lines 3 – 5), wherein said

antiferromagnetic layer (AFM_1) and bias layers (AFM_2) each comprise an alloy containing at least one element selected from the group consisting of Pt, Pd, Rh, Ru, Ir, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe, and Kr, as well as Mn (col. 5, lines 59 – 62 and col. 6, lines 45 – 50). See also Lin, col. 5, line 26 bridging col. 7, line 38 for the entire description of Figure 3. Lin fails to disclose the spacing between the soft magnetic layers as corresponding to a track width between said soft magnetic layers, but this limitations is an intended use limitation and is also deemed to inherently be met by Lin since one of ordinary skill in the art would know that the distance between the two soft magnetic layers ***is*** the track width in a spin-valve MR sensor (see applicant's disclosure, paragraph bridging pages 5 and 6 and Figure 14).

Regarding claim 7, Lin discloses the soft magnetic layers as being preferably NiFe (col. 6, lines 34 - 35).

Regarding claim 8, Lin discloses a free magnetic layer meeting applicant's claimed limitations (Figure 3, recesses are the regions where element 41 is deposited).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin ('767).

Regarding claims 3 and 4, Lin discloses the claimed invention as described above.

Lin fails to explicitly disclose a Mn-X alloy meeting applicant's claimed limitations.

However, Lin teaches Pd-Mn, Ir-Mn and Rh-Mn alloys as suitable alloys for the various anti-ferromagnetic layers (col. 5, lines 59 – 62 and col. 6, lines 45 – 50) and, barring any atomic percentages, one of ordinary skill in the art would deem that these alloys were 50-50 mixtures since writing elements without any atomic percents or stoichiometric values is a known way to write equivalent amounts.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Lin to use Mn-X alloys meeting applicant's claimed limitations as taught by Lin since the it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. In the instant case, Lin discloses the compositions as known materials and an atomic percent of 50% Mn reads on applicant's claimed limitations.

13. Claims 2 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin as applied above, and further in view of Rottmayer et al. (U.S. Patent No. 6,201,673) and applicant's admissions.

Regarding claims 2 and 9, Lin discloses the claimed invention as described above.

Lin fails to disclose a free magnetic layer comprising a first free magnetic layer, a second free magnetic layer and a non-magnetic layer interposed between them, nor the magnetization directions and thickness values of the two free magnetic layers.

However, Rottmayer et al. teach that it is old in the art to use a "synthetic free magnetic layer" comprising a free magnetic layer meeting applicant's claimed limitations inorder to maintain a high magnetoresistance and allow for higher reading densities (col. 1, lines 54 – 67). Rottmayer et al. further disclose that the magnetization directions are in directions 180° different from each other (col. 4, lines 5 – 8 and Figure 1B) and that the thickness of each layer can be optimized to control the relative magnetic moments and the mean free path of the electrons (col. 1, line 62 bridging col. 2, line 9; col. 4, lines 15 – 23).

Rottmayer et al. fail to disclose whether the first or second free magnetic layer should be the thicker layer.

However, applicant admits that it is old in the art to form a synthetic free magnetic layer where the relative magnetic moments can be optimized by controlling the thickness of the layers to meet applicants' claimed limitations (specification, page 9, line 6 bridging page 11, line 5).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Lin to use a synthetic free magnetic layer meeting applicant's claimed limitations as taught by Rottmayer et al. and applicant inorder to maintain a high magnetoresistance and allow for higher reading densities.

14. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin in view of Rottmayer et al. and applicant's admissions as applied above, and further in view of Kishi et al. (U.S. Patent No. 6,007,643).

Lin in view of Rottmayer et al. and applicant's admissions disclose the claimed invention as described above.

Regarding claims 5 and 6, none of the above disclose a PtMn-X alloy meeting applicant's claimed limitations.

However, Kishi et al. teach PtMn-X alloys meeting applicant's claimed limitations as good antiferromagnetic layers in MR sensors since they possess superior corrosion resistance (col. 2, lines 48 – 62; col. 3, line 56 bridging col. 4, line 20; claim 1; and Figures 8 and 9).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Lin in view of Rottmayer et al. and applicant's admissions to use a PtMn-X antiferromagnetic composition as taught by Kishi et al. inorder to form antiferromagnetic layers possessing superior corrosion resistance.

15. Claims 1 – 4 and 7 – 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rottmayer et al. ('673) in view of applicant's admissions.

Regarding claim 1, Rottmayer et al. disclose a spin-valve magnetoresistive (MR) sensor comprising, on a substrate (Figure 4, element 101'), an antiferromagnetic layer (element 106'), a pinned magnetic layer formed in contact with said antiferromagnetic

layer (element 108') and having a magnetization direction made stationary under an exchange anisotropic magnetic field generated by interaction with said antiferromagnetic layer (inherent, see also col. 4, lines 5 – 7 and Figure 1B), a non-magnetic layer (element 110') formed between a free magnetic layer (element 120') and said pinned magnetic layer, soft magnetic layers (elements 139) arranged on said free magnetic layer having a spacing corresponding to a track width between said soft magnetic layers (col. 8, lines 9 – 11), bias layers (131') formed on said soft magnetic layers to uniformly arrange a magnetization direction of said free magnetic layer in a direction crossing the magnetization direction of said pinned magnetic layer (inherent, see also col. 4, lines 5 – 7 and Figure 1B and 3B), and electrically conductive layers (element 133') to apply a detection electric current to said free magnetic layer (intended use limitation, but see col. 3, lines 64 – 65 and col. 8, lines 55 - 65), wherein said bias layers (131') each comprise an alloy containing at least one element selected from the group consisting of Pt, Pd, Rh, Ru, Ir, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe, and Kr, as well as Mn (col. 8, lines 30 – 54 and claim 3). See also Rottmayer et al., col. 5, line 30 bridging col. 7, line 11 for the entire description of Figure 4.

Rottmayer et al. fail to disclose specific antiferromagnetic alloys used for the antiferromagnetic layer.

However, Rottmayer et al. gives a short list of antiferromagnetic materials, of which several meet applicants' claimed limitations and also teach that the only provision in choosing an anti-ferromagnetic layer is to insure that the blocking temperature of the antiferromagnetic layer (106') should be higher than that of the bias layers (139) (col. 8,

lines 30 – 33 and lines 50 – 54). Since Mn-X alloys meeting applicant's claimed limitations are a known antiferromagnetic material disclosed by Rottmayer et al. useable in forming antiferromagnetic layers for MR sensors, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a Mn-X alloy meeting applicants' claimed limitations, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Rottmayer et al. further fail to disclose the non-magnetic spacer layer as being electrically conductive.

However, applicant's teach that that it is known in the art that the non-magnetic spacer layer is an electrically conductive material inorder for the MR head to function (col. 5, lines 10 – 16).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Rottmayer et al. to use an electrically conductive spacer layer as taught by applicant's since it is necessary for the MR head to function properly and is therefor within the knowledge of one of ordinary skill in the art.

Regarding claims 2 and 9, Rottmayer et al. and applicant's disclose the claimed limitations as described above (Paragraph 13).

Regarding claims 3 and 4, Rottmayer et al. disclose Mn-X alloys meeting applicant's claimed limitations since it is deemed that Mn-X would be known to one of

ordinary skill in the art to represent a 50% atomic percent Mn composition (col. 8, lines 30 - 33).

Regarding claim 7, Rottmayer et al. disclose NiFe as the preferred soft magnetic material for element 139 (col. 8, lines 24 - 28).

Regarding claim 8, Rottmayer et al. disclose etching the capping layer until the free ferromagnetic layer is exposed (col. 8, lines 19 – 24). The examiner deems that etching inherently results in some removal of the free ferromagnetic layer, resulting in a recess prior to deposition of the soft magnetic layers (139) (col. 8, lines 24 – 28). As such, the examiner deems that the free ferromagnetic layer would inherently possess recesses where the soft magnetic layer is deposited given that Rottmayer et al. teach ion milling the capping layer until the free ferromagnetic layer is exposed.

16. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rottmayer et al. in view of applicant's admissions as applied above, and further in view of Kishi et al. (643).

Regarding claims 5 and 6, Rottmayer et al. in view of applicant's admissions disclose the claimed invention as described above.

Neither Rottmayer et al. nor applicant disclose a PtMn-X alloy meeting applicant's claimed limitations.

However, Kishi et al. teach PtMn-X alloys meeting applicant's claimed limitations as good antiferromagnetic layers in MR sensors since they possess superior corrosion

resistance (col. 2, lines 48 – 62; col. 3, line 56 bridging col. 4, line 20; claim 1; and Figures 8 and 9).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Rottmayer et al. in view of applicant's admissions to use a PtMn-X antiferromagnetic composition as taught by Kishi et al. inorder to form antiferromagnetic layers possessing superior corrosion resistance.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (703) 308-1737. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (703) 308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0651.

KMB
April 30, 2002

STEVAN A. RESAN
PRIMARY EXAMINER